Claims

What is claimed is:

1. A process for making a layered composite structure for a panel structure mountable in a vehicle to part of the interior thereof in concealing relation to a secondary restraint system, said process comprising:

forming on a mold surface the layered composite structure comprising an outer layer defining at least a portion of an exterior surface of the panel structure, an inner layer adjacent the outer, said inner layer including a seam defining structure adhered to the inner layer defining a frangible line of an invisible tear seam corresponding with the secondary restraint system.

2. A process as defined in claim 1, wherein said forming of the layered composite structure comprises:

establishing the outer layer on the mold surface so as to have a configuration complementary to mold surface;

applying the seam defining structure on the inner surface of the outer layer while the outer layer is on the mold surface; and

applying the inner layer over the inner surface of the outer layer and the seam defining structure applied thereto while the outer layer is on the mold surface to adhere the outer layer thereto.

3. A process as defined in claim 1, wherein said forming of the layered composite structure comprises:

establishing the outer layer on the mold surface so as to have a configuration complementary to the mold surface;

applying a first portion of the inner layer on the inner surface of the outer layer while the outer layer is on the mold surface to adhere the outer layer thereto;

applying the seam defining structure on the inner surface of the first portion of the inner layer while the outer layer is on the mold surface and positioning the narrow seam defining structure to define the exteriorly invisible tear seam; and

applying a second portion of the inner layer over the inner surface of the first portion of the inner layer and the seam defining structure applied thereto while the outer layer is on the mold surface.

4. A process as defined in claim 1, wherein said forming of the layered composite structure comprises:

establishing the outer layer on the mold surface so as to have a configuration complementary to the mold surface;

applying the inner layer on the inner surface of the outer layer while the outer layer is on the mold surface to adhere the outer layer thereto;

applying the seam defining structure on an inner surface of the inner layer while the outer layer is on the mold surface; and

pressing the narrow seam defining structure into the inner layer while the inner layer is in a reactive state to embed the seam defining structure in the inner layer.

5. A process as defined in claims 2 to 4, wherein the seam defining structure comprises a thermoplastic material.

6. A process defined in claims 2 to 4, wherein the seam defining structure comprises a sheet structure.

7. A process as defined in claim 6, wherein the sheet structure comprises an open mesh fabric.

8. A process as defined in claim 7, where in the open mesh fabric comprises a fiber glass mat treated with an adhesive coupling agent compatible to bond with the inner layer.

9. A process as defined in claims 7 or 8 wherein said sheet structure is severed along said frangible line.

10. A process as defined in claim 9, wherein the severed sheet structure comprises peripheral walls surrounding the invisible tear seam and protruding from the inner layer away from the outer layer.

11. A process as defined in claims 2 to 4, wherein the seam defining structure comprises twine.

12. A process according to claims 5, 6 or 11, wherein said establishing of the outer layer on the mold surface comprises:

applying a water-dispersed composition onto the mold surface, the water-dispersed composition comprising at least one light-stable thermoplastic polyurethane, at least one coloring agent, and at least one heat-activated crosslinker,

applying sufficient heat to induce partial crosslinking of the light-stable thermoplastic polyurethane with the crosslinker, and

substantially drying the water-dispersed composition while on the mold surface so as to establish the outer layer; and

the inner layer is formed by applying a composition onto an inner surface of the outer layer and, crosslinking the inner layer which extends about the seam defining structure with the polyurethane of the outer layer via residual unreacted functional groups of the crosslinker to form interfacial chemical bonding between the inner surface of the outer layer and an adjacent surface of the inner layer.

13. A process according to claim 12, wherein the outer layer has a thickness in a range of from about 0.0025 cm to about 0.0038 cm.

14. A process according to claim 13, wherein the inner layer has a thickness in a range of from about 0.10 cm to about 0.15 cm.

15. A process according to claim 12, wherein the mold surface has a complementary configuration to an exterior surface of a door panel.

16. A process according to claim 12, wherein the mold surface has a complementary configuration to an exterior surface of an instrument panel.

17. A process according to claim 12, wherein the composition from which the inner layer is formed comprises an aromatic polyisocyanate, and wherein the crosslinker is a blocked, heat-activated diisocyanate.

18. A process according to any one of the preceding claims wherein the process further comprises a step of uniting the layered composite structure after the formation thereof with a reinforcing substrate so that the reinforcing substrate reinforces the layered composite structure in such a way that the layered composite structure fractures generally along the tear seam in response to the operation of the secondary restraint system.

19. A process as defined in claim 18, wherein said uniting of the layered composite structure with the reinforcing substrate comprises placing a rapid reacting mixture between the layered composite structure and the reinforcing substrate and forming a cellular polyurethane foam therefrom.

20. A layered composite structure for a panel structure mountable in a vehicle to form a part of the interior thereof, said panel structure having an exterior surface exposed to the vehicle interior and an interior surface disposed in cooperating and concealing relation with a secondary restraint system, said layered composite structure comprising:

an outer layer with an opaque visual appearance defining an exposed exterior surface of said panel structure; and

an inner layer adhered to an inner surface of said outer layer and including an adhesively bonded seam defining structure, said seam defining structure defining a frangible line corresponding to an invisible tear seam which fractures in response to operation of the secondary restraint system.

21. A layered composite structure as defined in claim 20, wherein the seam defining structure comprises a thermoplastic material.

22. A layered composite structure defined in claim 20, wherein the seam defining structure comprises a sheet structure.

23. A layered composite structure as defined in claim 22, wherein the sheet structure comprises an open mesh fabric.

24. A layered composite structure as defined in claim 23, where in the open mesh fabric comprises a fiber glass mat.

25. A layered composite structure as defined in claims 22, 23 or 24 wherein said sheet structure is severed along said line.

26. A layered composite structure as defined in claim 25, wherein the severed sheet structure comprises peripheral walls surrounding the invisible tear seam and protruding from the inner layer away from the outer layer.

27. A layered composite structure as defined in claim 20, wherein the seam defining structure comprises twine.

28. A layered composite structure according to claims 21, 22 or 27, wherein

said outer layer comprises: a water-dispersed composition comprising at least one light-stable thermoplastic polyurethane, at least one coloring agent, and at least one heat-activated crosslinker; and

the inner layer is a composition which crosslinks the inner layer about the seam defining structure with the polyurethane of the outer layer via residual unreacted functional groups of the crosslinker to form interfacial chemical bonding between the inner surface of the outer layer and an adjacent surface of the inner layer.

29. A layered composite structure according to claim 28, wherein the outer layer has a thickness in a range of from about 0.0025 cm to about 0.0038 cm.

30. A layered composite structure according to claim 29, wherein the inner layer has a thickness in a range of from about 0.10 cm to about 0.15 cm.

31. A layered composite structure according to claim 28, wherein the layered composite structure has a configuration of an exterior surface of a door panel.

32. A layered composite structure according to claim 28, wherein the layered composite structure has a configuration of an exterior surface of an instrument panel.

33. A layered composite structure according to claim 28, wherein the composition from which the inner layer is formed comprises an aromatic polyisocyanate, and wherein the crosslinker is a blocked, heat-activated diisocyanate.

34. A layered composite structure according to any one of the preceding claims wherein the layered composite structure is united with a reinforcing substrate so that the reinforcing substrate reinforces the layered composite structure in such a way that the layered composite structure fractures generally along the tear seam in response to the operation of the secondary restraint system.

35. A layered composite structure as defined in claim 34, wherein a rapid reacting mixture which forms a cellular polyurethane foam unites the layered composite structure and the reinforcing substrate and therefrom.